UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,509	10/31/2003	Dhruva Ranjan Chakrabarti	200314557-1	9606

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EXAMINER
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ART UNIT	PAPER NUMBER
2192	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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	Application No.	Applicant(s)
Office Action Summary	10/698,509	CHAKRABARTI ET AL.
	Examiner	Art Unit
	Thuy Dao	2192

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>13 October 2008</u>.
2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-13</u> is/are pending in the application.
    4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) <u>1-13</u> is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on <u>31 October 2003</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☐ All   b)☐ Some * c)☐ None of:
      1.☐ Certified copies of the priority documents have been received.
      2.☐ Certified copies of the priority documents have been received in Application No. _____.
      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)
1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the amendment filed on October 13, 2008.

2. Claims 1-13 have been examined.

Response to Amendments

3. In the instant amendment, claim 13 has been amended.

4. The objection to the drawings and claim 13 is withdrawn in view of Applicant's amendments.

Response to Arguments

5. Applicants' arguments have been considered but are not persuasive.

In regard to Kramskoy (US Patent No. 7,080,366):

a) The Applicants asserted, *"First, FIG. A5 and portions of the text are cited against the limitation of being "given a call-graph". However, FIG. A5 and the cited text refer to a call stack, not a call graph. Both a "call stack" and a "call graph" are terms of art in the computer programming field. They mean completely different things."* (Remarks, page 7, second paragraph, emphasis added).

The examiner respectfully disagrees with Applicants' assertions.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

As set forth in the previous Office action mailed August 14, 2008, Kramskoy was not relied upon to reject the particular limitation "call-graph" and pages 3-4 clearly set forth:

> "Kramskoy does not explicitly disclose a *call-graph.*
>
> However, in an analogous art, Berry further discloses *a call-graph* (e.g., FIG. 11A-B and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One would have been motivated to do so <u>as one of many ways to reflects the call stacks</u> as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, <u>call stacks presented as either tree</u> or table)" – emphasis added.

b) The limitation "common call site" (e.g., claim 1, line 3 and Remarks, page 7):

The examiner respectfully disagrees with Applicants' assertions.

FIG. 1E, code block 1072 is indeed a common call site of block code 1080 (regular execution) and Exception Handler 1078 (e.g., col.13: 44-49; col.39: 10-38).

FIG. 1E, code block 1080 is indeed a common call site of code blocks 1082-1082 (non-dominant execution path) and code block 1083 (frequently executed/dominant execution path).

FIG. 1E, code block 1084 is indeed a common call site of code block 1086 (non-dominant exit) and code block 1085 (frequently executed/dominant exit).

c) The limitation "inline the common call site in one or more of the <u>call-chains</u>" (e.g., claim 1, line 4 and Remarks, page 7, emphasis added):

As explicitly illustrated in FIG. 1E, dominant path 1088 is indeed a call-chain, i.e., each previous code block calls subsequent code block from the entry point 1074 to the exit point 1085 (e.g., col.13: 44-49; col.39: 10-38).

In regard to Berry (US Patent No. 6,651,243):

The Applicants asserted, "*...Berry is cited in relation to FIGS. 11 and 12 as disclosing a call graph. However, applicants respectfully submit that FIGS. 11 and 12 of Berry show call stacks, not call graphs. <u>Call stacks</u>, whether <u>in tree</u> or table form, <u>are not call graphs</u>. As discussed above, a call graph indicates calling relationships*" (Remarks, first paragraph, emphasis added).

The examiner respectfully disagrees with Applicants' assertions. As well-known in the art, <u>call trees are also called call graphs</u>:

US Patent No. 6,539,543, col.6: 36-41, "*<u>Function call graph 20 is a call tree</u> representing function calls in source code 10. It is used in the "flattening" phase and caches information for all function calls in the source code. Every function in the source code is represented by a node in the tree and every function call is represented by an edge*" (emphasis added);

US Patent No. 7,058,928, col.2: 45-49, "*For example, <u>the function call graph</u> in a serial environment is <u>a simple tree</u>. In a parallel processing environment, the function <u>call graph</u> is no longer a simple tree, but <u>a collection of trees</u>*" (emphasis added); and

US Patent No. 6,026,362, col.3: 64 – col.4: 5, "*For example, the debugger could display a tree-like graphical representation of the program, wherein each function comprising the program is represented by <u>a node on the graph and the call relationships</u> between functions are illustrated by lines interconnecting the nodes. <u>Such a graph is known as a call tree</u>*" (emphasis added).

Berry explicitly teaches:

"With reference now to <u>FIG. 11A</u>, a diagram depicts a tree structure generated from trace data. This figure illustrates a <u>call stack tree</u> 1100 in which each node in tree structure 1100 represents a function entry point"

"With reference now to <u>FIG. 11B, a call stack tree</u> which reflects <u>call stacks</u> observed during a specific example of system execution will now be described. At each node in the tree, several statistics are recorded. In the example shown in FIG. 11B, the statistics are time-based statistics. The particular statistics shown include the number of distinct times the <u>call stack</u> is produced, the sum of the time spent in the call stack, the total time spent in the call stack plus the time in <u>those call stacks invoked from this call</u>

> stack (referred to as cumulative time), and the number of instances
> of this routine above this instance (indicating depth of recursion)",
> emphasis added, i.e., call stack are presented/reflected by
> call tree/graph.

6. Independent claims 7 and 13 recite similar limitations to those discussed above in relation to claim 1 (Remarks, page 8). Hence, for at least the above responses, claims 7 and 13 are also rejected in view of Kramskoy and Berry.

Dependent claims 2-6 and 8-12 depend from claims 1 and 7, respectively, are also rejected for at least the responses discussed above.

In conclusion, the examiner respectfully maintains ground of the 35 USC §103 rejection over claims 1-13.

Claim Rejections – 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kramskoy (art of record, US Patent No. 7,080,366) in view of Berry (art of record, US Patent No. 6,651,243).

Claim :

Kramskoy discloses *a method of compiling a computer program with inline specialization, the method comprising:*

given a call stack/call frames (e.g., FIG. A5, col.63: 8 – col.64: 42; col.39: 14-23),

if multiple call-chains in the call stack/call frames have a common call site (e.g., FIG. 1E, col.20: 10-49, common call sites as 1072, 1080, 1084),

inlining the common call site in one or more of the call-chains (e.g., FIG. 1E, inlining the common call sites 1072, 1080, 1084 in a dominant path 1088, col.20: 27 – col.21: 20; col.39: 14-23; col.13: 44-49; col.39: 10-38).),

without inlining the common call site into all of said multiple call-chains having the common call site (e.g., FIG. 1E, without inlining 1078, 1082, 1086 into said dominant path, col.20: 31-62).

Kramskoy does not explicitly disclose a *call-graph.*

However, in an analogous art, Berry further discloses *a call-graph* (e.g., FIG. 11A-B and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One would have been motivated to do so as one of many ways to reflects the call stacks as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, call stacks presented as either tree or table).

Claim 2:

The rejection of claim 1 is incorporated. Kramskoy discloses *whenever a call site from routine x to routine y is inlined, new call sites are added from routine x to all routines inlinable within routine y* (e.g., col.79: 6-36; col.85: 48-67).

Claim 3:

The rejection of claim 2 is incorporated. Berry further discloses *materialization of summary information for the new call sites added to the call-graph* (e.g., col.18: 19-49, FIG. 11-12 and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One

would have been motivated to do so as one of many ways to reflects the call stacks as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, call stacks presented as either tree or table).

Claim 4:

The rejection of claim 3 is incorporated. Kramskoy discloses *addition of the new call sites to a global work-list so that the new call sites are considered for inlining* (e.g., col.85: 48-67; col.86: 36-61).

Claim 5:

The rejection of claim 4 is incorporated. Kramskoy discloses *addition of dependence relationships between call sites, wherein if a new call site, y, is added because of inlining of call site, x, then y is dependent on x* (e.g., col.86: 36-61; col.84: 13-64).

Claim 6:

The rejection of claim 5 is incorporated. Kramskoy discloses *patching of the new call site, y, during inline transformation of call site, x, and generating an intermediate transformation for the new call site, y* (e.g., col.79: 6-36; col.86: 6-35).

Claim 7:

Kramskoy discloses *an apparatus for compiling a computer program with inline specialization* (e.g., FIG. A5, col.63: 8 – col.64: 42; col.39: 14-23), *the apparatus comprising:*

memory configured to store computer-readable instructions and data; a processor configured to access said memory and to execute said computer-readable instructions (e.g., FIG. 1E, col.20: 10-49, common call sites as 1072, 1080, 1084),*;*

computer-readable instructions stored in said memory and configured to inline a common call site in one or more call-chains in a call stack/call frames (e.g., FIG.

1E, inlining the common call sites 1072, 1080, 1084 in a dominant path 1088, col.20: 27
– col.21: 20; col.39: 14-23; col.13: 44-49; col.39: 10-38),

without inlining the common call site into all call-chains having the common call site (e.g., FIG. 1E, without inlining 1078, 1082, 1086 into said dominant path, col.20: 31-62).

Kramskoy does not explicitly disclose a *call-graph.*

However, in an analogous art, Berry further discloses *a call-graph* (e.g., FIG. 11A-B and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One would have been motivated to do so as one of many ways to reflects the call stacks as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, call stacks presented as either tree or table).

Claim 8:

The rejection of claim 7 is incorporated. Kramskoy discloses *whenever a call site from routine x to routine y is inlined, new call sites are added from routine x to all routines inlinable within routine y* (e.g., col.84: 13-64; col.86: 6-35).

Claim 9:

The rejection of claim 8 is incorporated. Berry further discloses *materialization of summary information for the new call sites added to the call- graph is performed* (e.g., col.18: 19-49, FIG. 11-12 and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One would have been motivated to do so as one of many ways to reflects the call stacks as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, call stacks presented as either tree or table).

Claim 10:

The rejection of claim 9 is incorporated. Kramskoy discloses *the new call sites are added to a global work-list so that the new call sites are considered for inlining* (e.g., col.85: 48-67; col.86: 6: 35).

Claim 11:

The rejection of claim 10 is incorporated. Kramskoy discloses *dependence relationships are created between call sites* (e.g., col.86: 6-35; col.79: 6-36).

Claim 12:

The rejection of claim 11 is incorporated. Kramskoy discloses *the inline transformation patches up an intermediate representation of the new call sites (by considering the dependence relationships) before potentially inlining the new call sites* (e.g., col.86: 36-61; col.84: 13-64).

Claim 13:

Kramskoy discloses *a computer-readable storage medium storing a computer program in executable form,*

the computer program being a source code compiler with cross-module optimization (e.g., FIG. A5, col.63: 8 – col.64: 42; col.39: 14-23),

the compiler including an inline specialization feature such that given a call stack/call frames (e.g., FIG. 1E, col.20: 10-49, common call sites as 1072, 1080, 1084),

if multiple call-chains in the call stack/call frames have a common call site (e.g., FIG. 1E, inlining the common call sites 1072, 1080, 1084 in a dominant path 1088, col.20: 27 – col.21: 20; col.39: 14-23; col.13: 44-49; col.39: 10-38),

the common call site is inlined in one or more of the call-chains, without having to inline the common call site into all of the multiple call-chains having the common call site (e.g., FIG. 1E, without inlining 1078, 1082, 1086 into said dominant path, col.20: 31-62).

Kramskoy does not explicitly disclose a *call-graph.*

However, in an analogous art, Berry further discloses *a call-graph* (e.g., FIG. 11A-B and related text).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Berry's teaching into Kramskoy's teaching. One would have been motivated to do so as one of many ways to reflects the call stacks as suggested by Berry (e.g., col.18: 19-49, FIG. 11-12, call stacks presented as either tree or table).

Conclusion

9. **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication should be directed to examiner Thuy Dao (Twee), whose telephone/fax numbers are (571) 272 8570 and (571) 273 8570, respectively. The examiner can normally be reached on every Tuesday, Thursday, and Friday from 6:00AM to 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam, can be reached at (571) 272 3695.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273 8300.

Any inquiry of a general nature of relating to the status of this application or proceeding should be directed to the TC 2100 Group receptionist whose telephone number is (571) 272 2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Thuy Dao/   /Tuan Q. Dam/

Examiner, Art Unit 2192   Supervisory Patent Examiner, Art Unit 2192